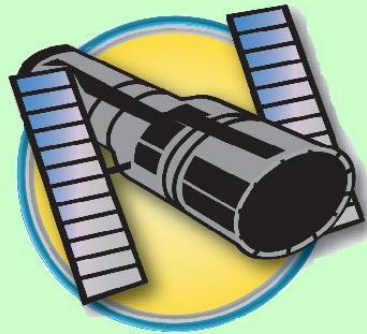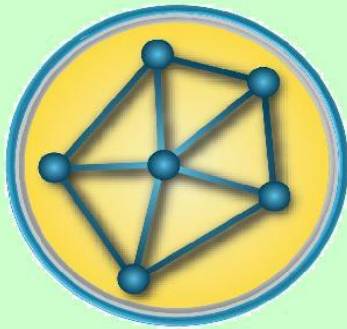# Washington State Reference Network

www.wsrn.org

CGSIC – CORS Forum
September 16th, 2008
Savannah, GA

Washington State RTN

- **WSRN (RTN) – Cooperative 90% Coverage**

- **RGPS (RTN) – Dealer / Partnerships 15% Coverage**

- **RGPS (Single Base) – Dealer / Partnerships 20% Coverage**

- **PC3N (RTN) – County Network 5% Coverage**

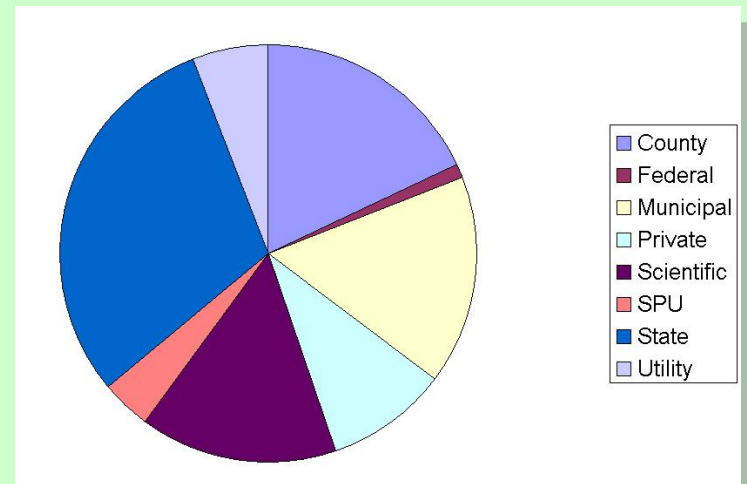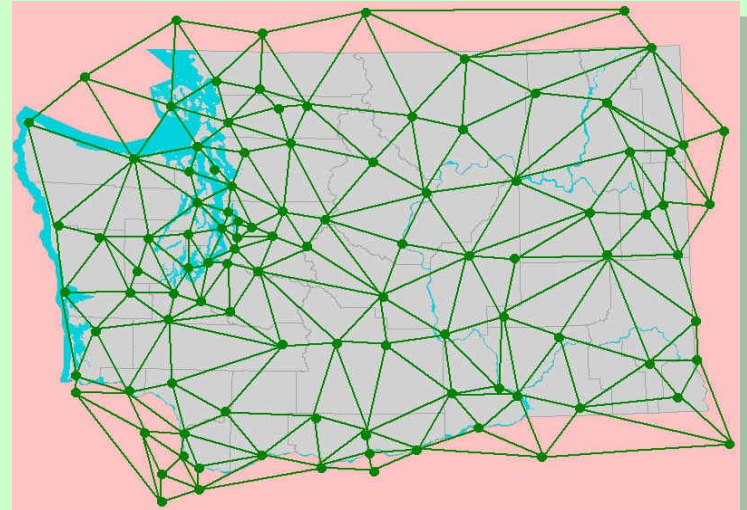- **PPI (RTN) – Dealer Network 10% Coverage**

All networks on NAD83 96CORS 2002.00 and all share some station data with WSRN

Washington State Reference Network

Quick Stats

- **90 of 95 Stations Completed**
- **600+ Active Accounts**
- **114,280 Minutes Avg. Monthly Fixed Solutions**
- **NAD83 – 96CORS Epoch 2002.00**
- **Cooperative – Public/Private**
- **70+ Infrastructure Partners**
- **80 Non-Infrastructure (Subscr.)**
- **42 Academic accounts**
- **35 Trainer / Dealer accounts**

County
Federal
Municipal
Private
Scientific
SPU
State
Utility

Washington State Reference Network

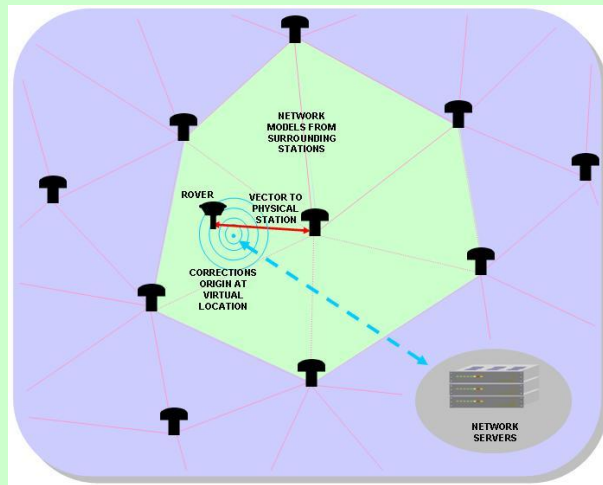## Other Stuff that NGS Wanted Me to Add

- **Latencies from CORS to RTN – 0.1 – 1.25 sec. (dependent on connection type)**
- **Latencies tracked in GPSNet synchronizers and Wireshark**
- **User Accuracies – 1cm Hz 3cm Vert (Ellipsoid)**
- **Server pairs; 40+ CORS each, RTN mirrored offsite**
- **Spacing – 50km – 70km (lowest 30km highest 100km)**
- **IT – RTN in DMZ, commercial DSL primary connections**
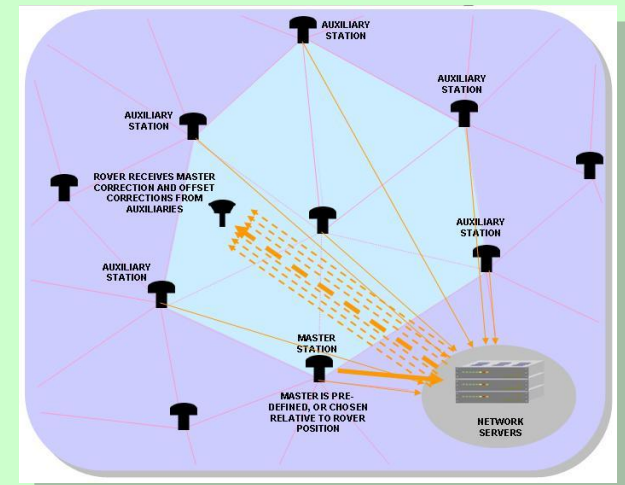- **60% GNSS CORS, full upgrade by 2010**

Washington State Reference Network
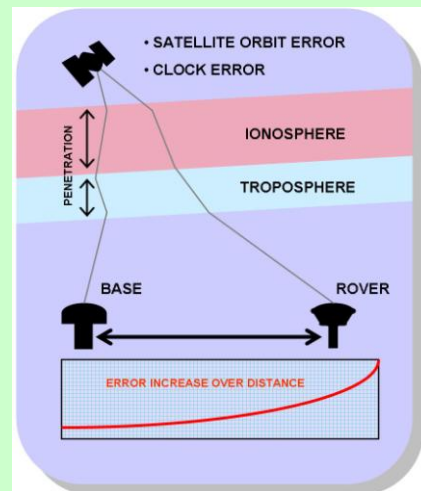
Real-Time Services

RTCM Standard Corrections
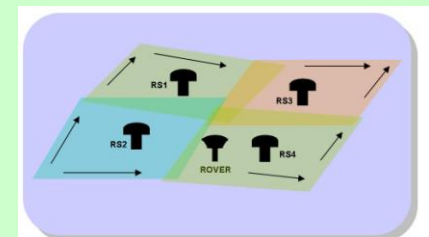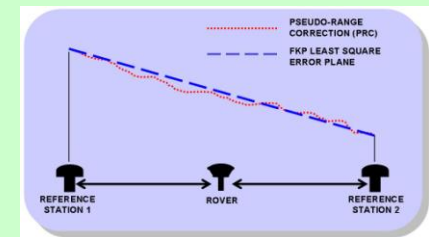

VRS

MAC (3Net)

Single-Base

FKP

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Business Model

- **Infrastructure – Partner Funded and Operated**

- **Central Processing Center – Seattle Public Utilities Funded and Operated**

- **Mirror Processing Center – Central Washington University Funded and Operated**

- **Operations Costs Offset by Subscriber Contributions**
  - » *Single Accounts - $1,900 Annual*
  - » *Five Accounts - $5,700 Annual*
  - » *Ten Accounts - $10,000 Annual*

- **Academic and Trainer/Dealer – No Fee**

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Adjustment of WSRN CORS Sites to the National Spatial Reference System
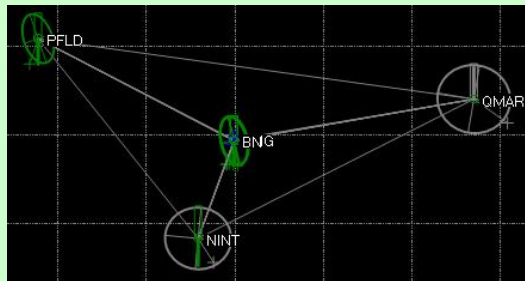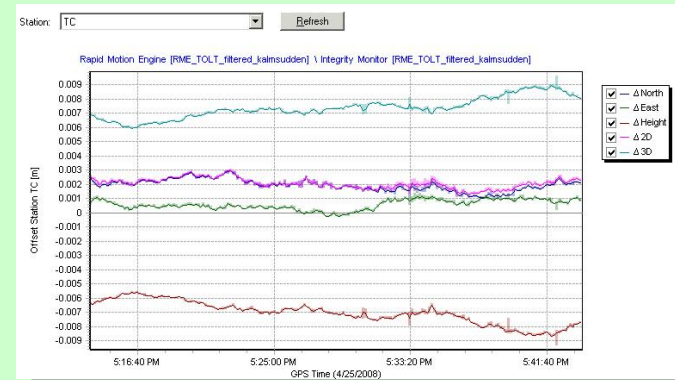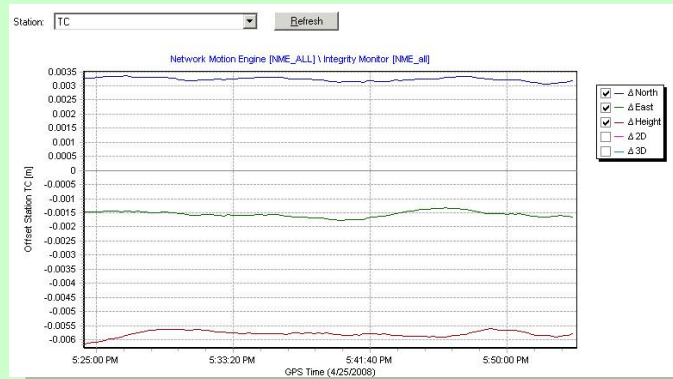
Legacy Method

- **360 Hours Data**
- **15 – 24hr OPUS (Extended Output)**
- **Evaluation Of NGS CORS to Hold**
- **Network Adjustments – External Software**
- **120 Hour Internal Coordinate Monitor Evaluation**
- **Ongoing Internal Coordinate Monitor Evaluations**

Stations positions are re-computed when out of tolerance (per Coordinate Monitor, or if any Hardware Changes or intake/changes to any adjacent stations)

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Integrity Monitor

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Adjustment of WSRN CORS Sites to the National Spatial Reference System

Integrity Monitor (IM) Method

- 360 Hours Data
- 15 – 24hr OPUS (Extended Output)
- Full Weekly NGS CORS Data
- Integrity Monitor (IM) Weekly on NGS CORS Data (Evaluate CORS to Hold)
- Weekly, Monthly, Quarterly IM PPS Sessions
- 3-Engine Real-Time IM Evaluations (alarms)
- Development of Velocity Data for Transformation Database

Legacy Evaluations will Continue to be Performed
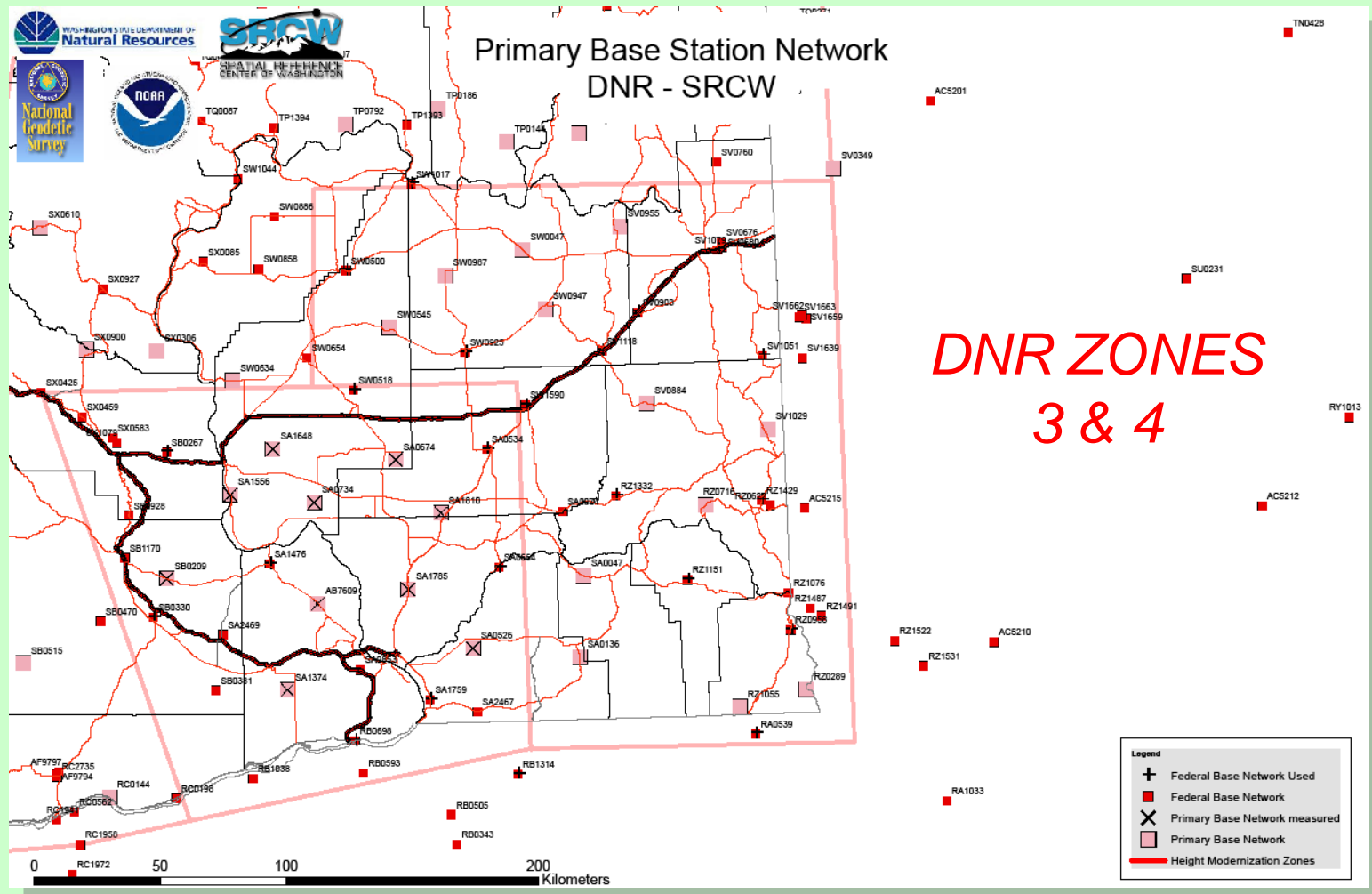
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Adjustment of WSRN CORS Sites INTO the National Spatial Reference System

- **Height Modernization**

- **Blue-Booking of 80+ RTN CORS**

- **OPUS-DB submission of stations**

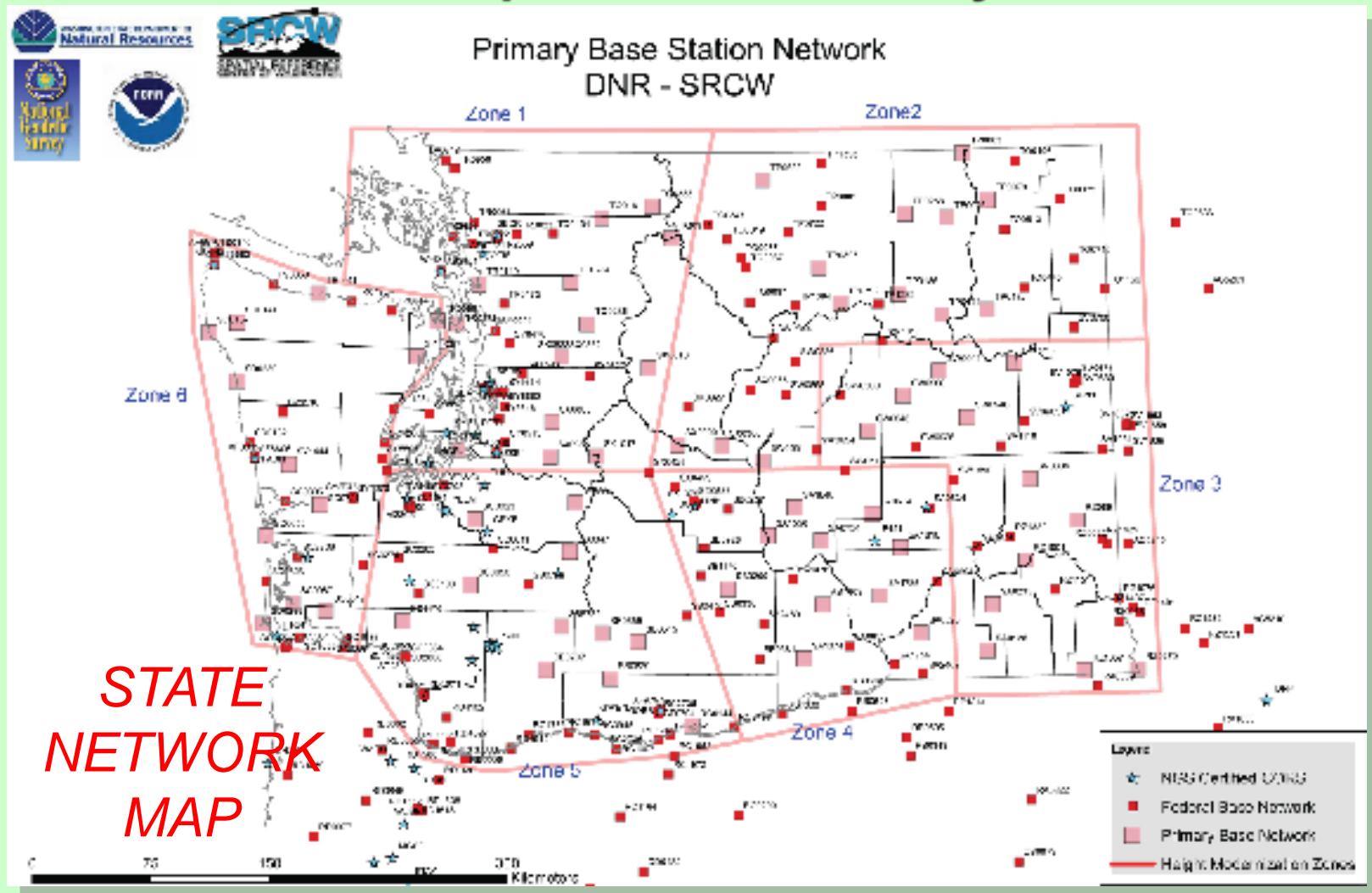- **Submission Of 20+ RTN-CORS to NGS CORS**

Height Modernization

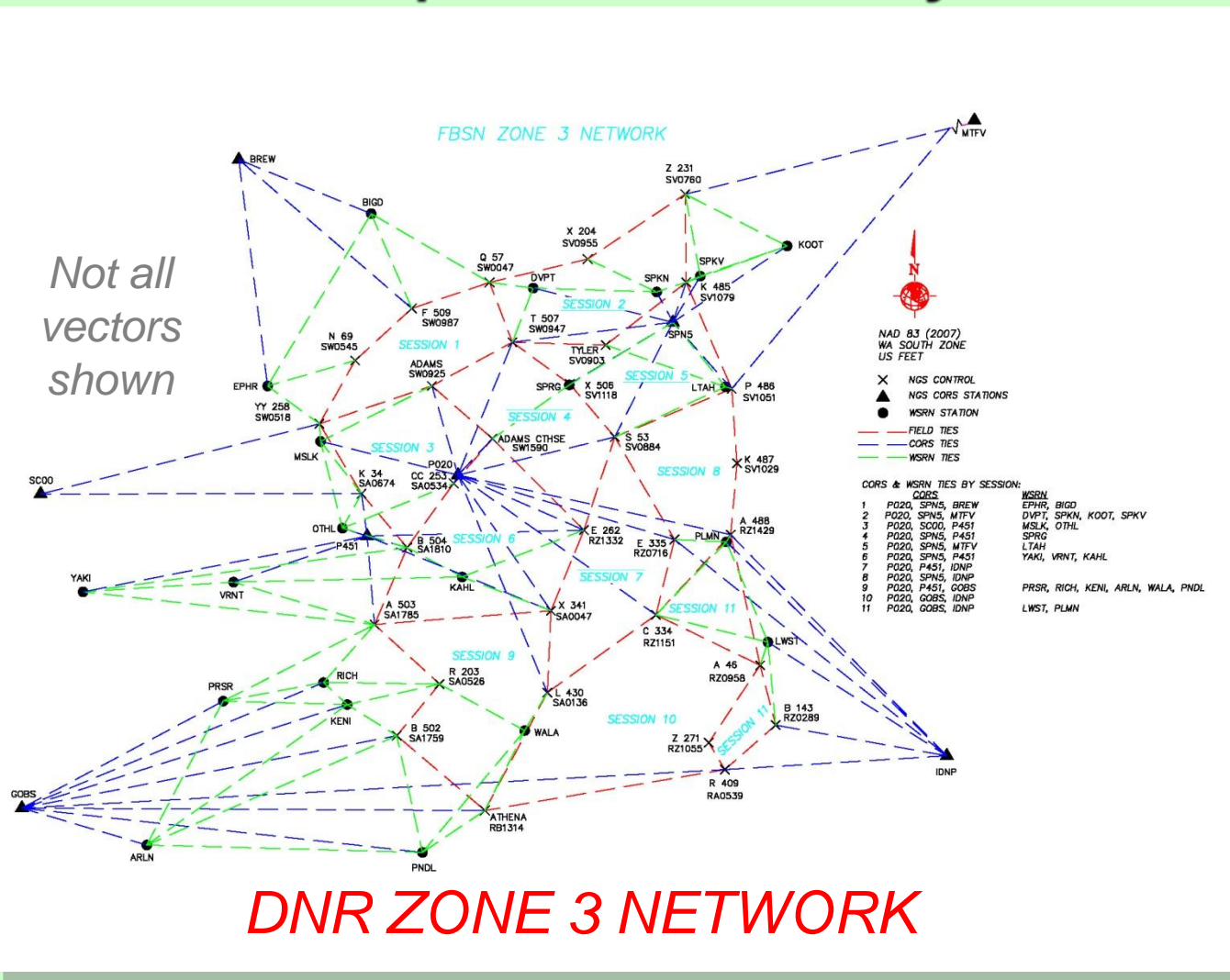## Adjustment of WSRN CORS Sites INTO the National Spatial Reference System

Height Modernization

Adjustment of WSRN CORS Sites INTO the National Spatial Reference System

STATE NETWORK MAP

Washington State Reference Network

Adjustment of WSRN CORS Sites INTO the National Spatial Reference System

Not all vectors shown

DNR ZONE 3 NETWORK

Washington State Reference Network

Adjustment of WSRN CORS Sites INTO the National Spatial Reference System

WSDOT Mount – Walla Walla

This mount will be there for a few years

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Adjustment of WSRN CORS Sites INTO the National Spatial Reference System

LTAH – Latah
Spokane County


```
DI3602  DESIGNATION -  LTAH CORS ARP

DI3602  PID         - DI3602

DI3602  STATE/COUNTY- WA/SPOKANE

DI3602  USGS QUAD   - LATAH (1980)

DI3602

DI3602                  *CURRENT SURVEY CONTROL

DI3602 _____

DI3602* NAD 83(1986)- 47 16 56.   (N)   117 08 50.   (W)    SCALED

DI3602* NAVD 88   -     754.185 (meters)   2474.36  (feet) ADJUSTED

DI3602 _____

DI3602  GEOID HEIGHT-     -18.15  (meters)            GEOID03

DI3602  DYNAMIC HT -     754.182 (meters)   2474.35  (feet) COMP

DI3602  MODELED GRAV-    980,583.4  (mgal)            NAVD 88

DI3602
```

KOOT - Kootenai
County Airport

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Adjustment of WSRN CORS Sites WITH NGS Marks for Height Modernization
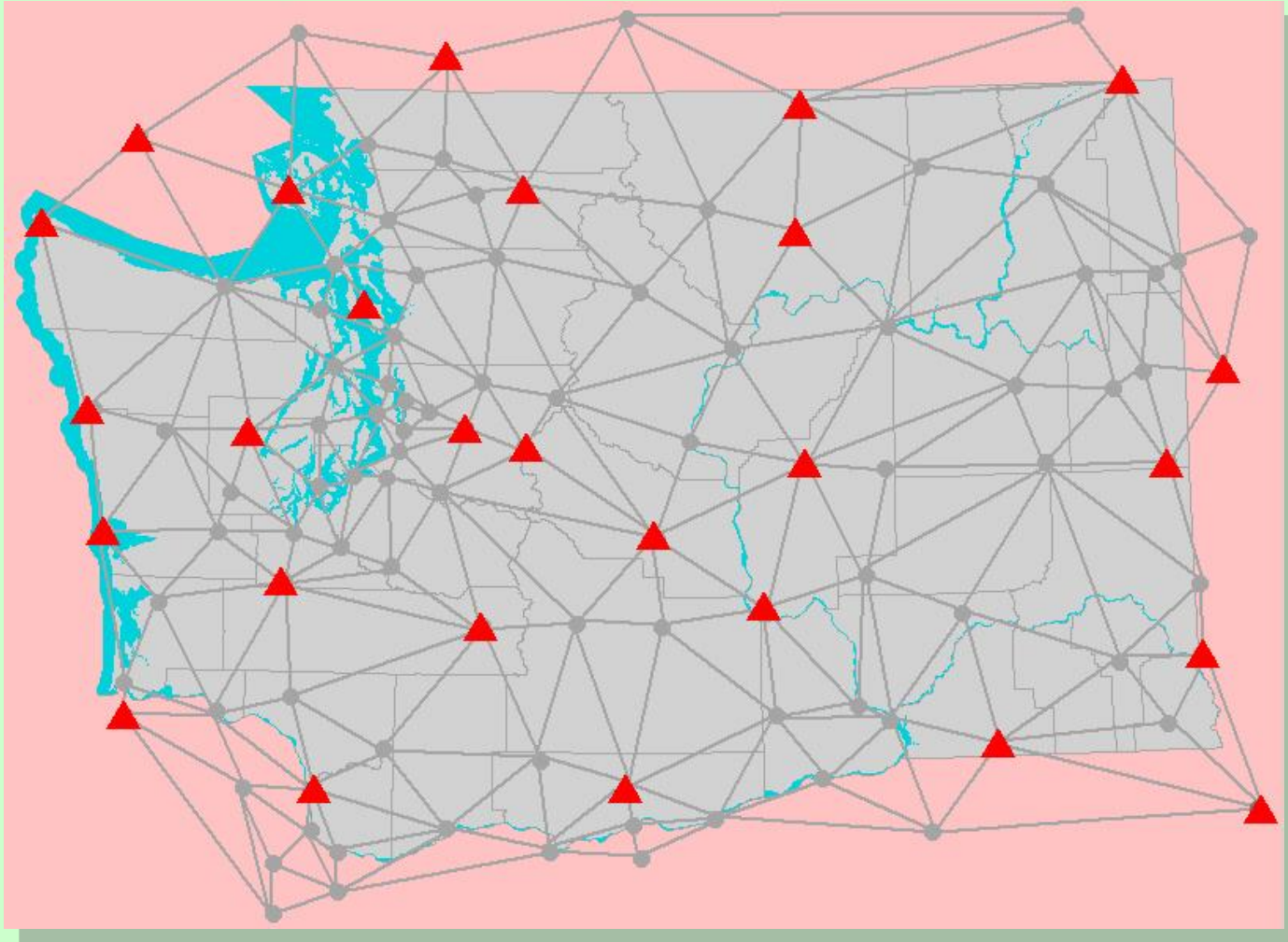
Washington State Reference Network

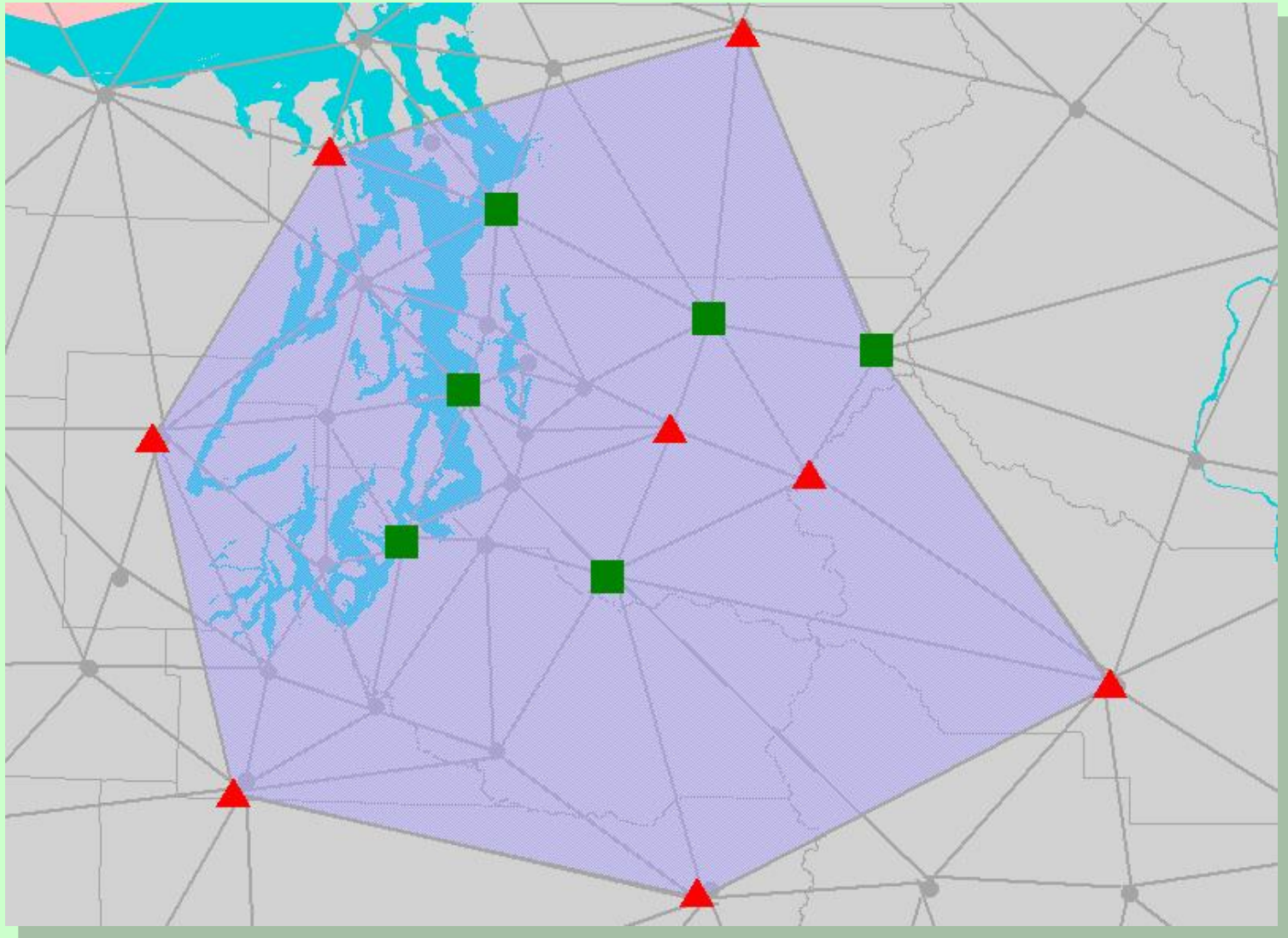## GIMI – GNSS Integrated Monitoring Initiative

Washington State Reference Network
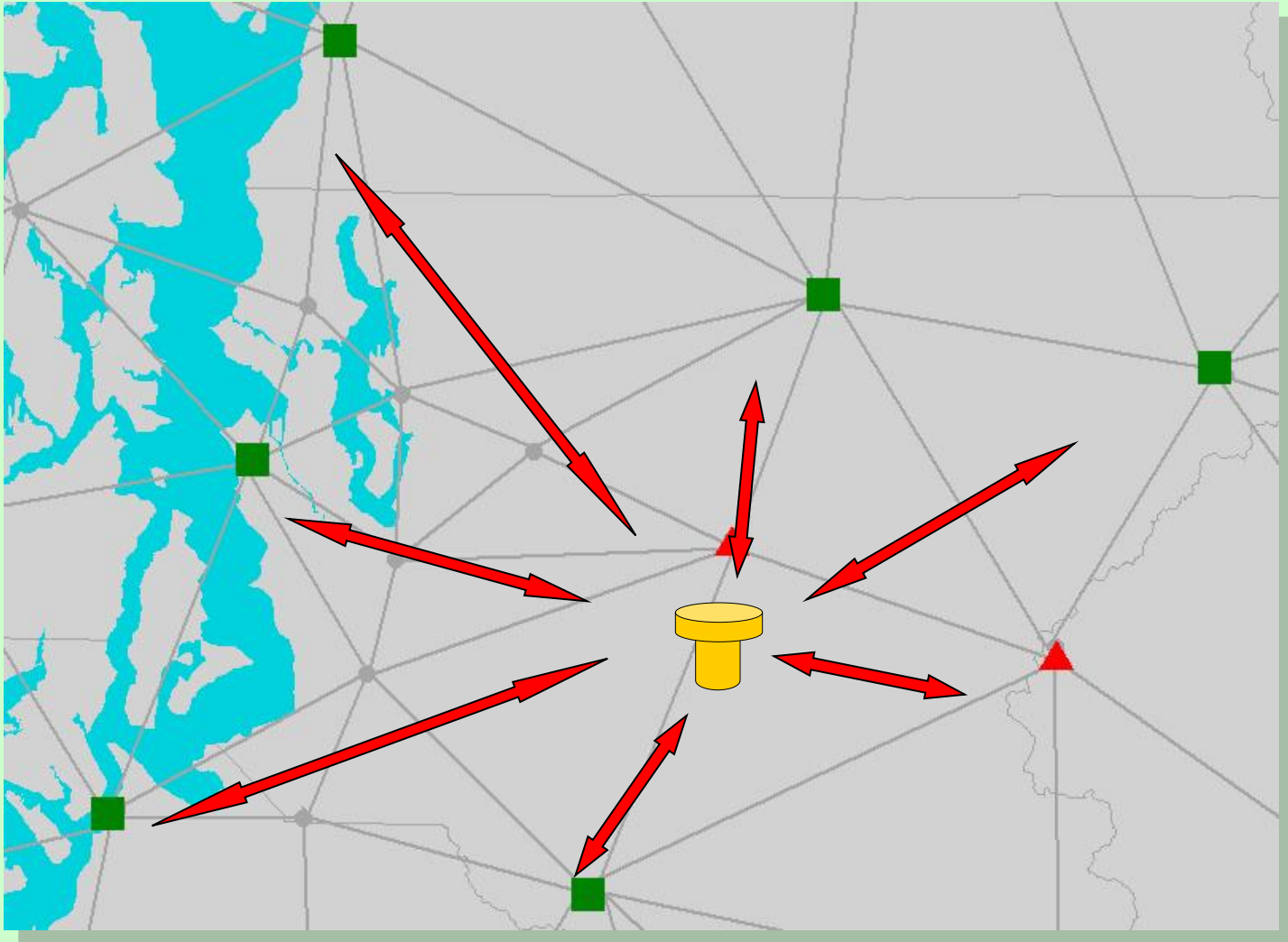## Localized Effects of Tectonic Movements

Primary Network Monitored by CWU

Washington State Reference Network

Secondary Networks Monitored by WSRN and CWU

Washington State Reference Network

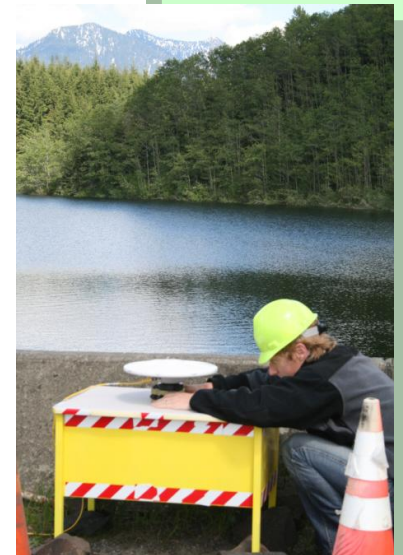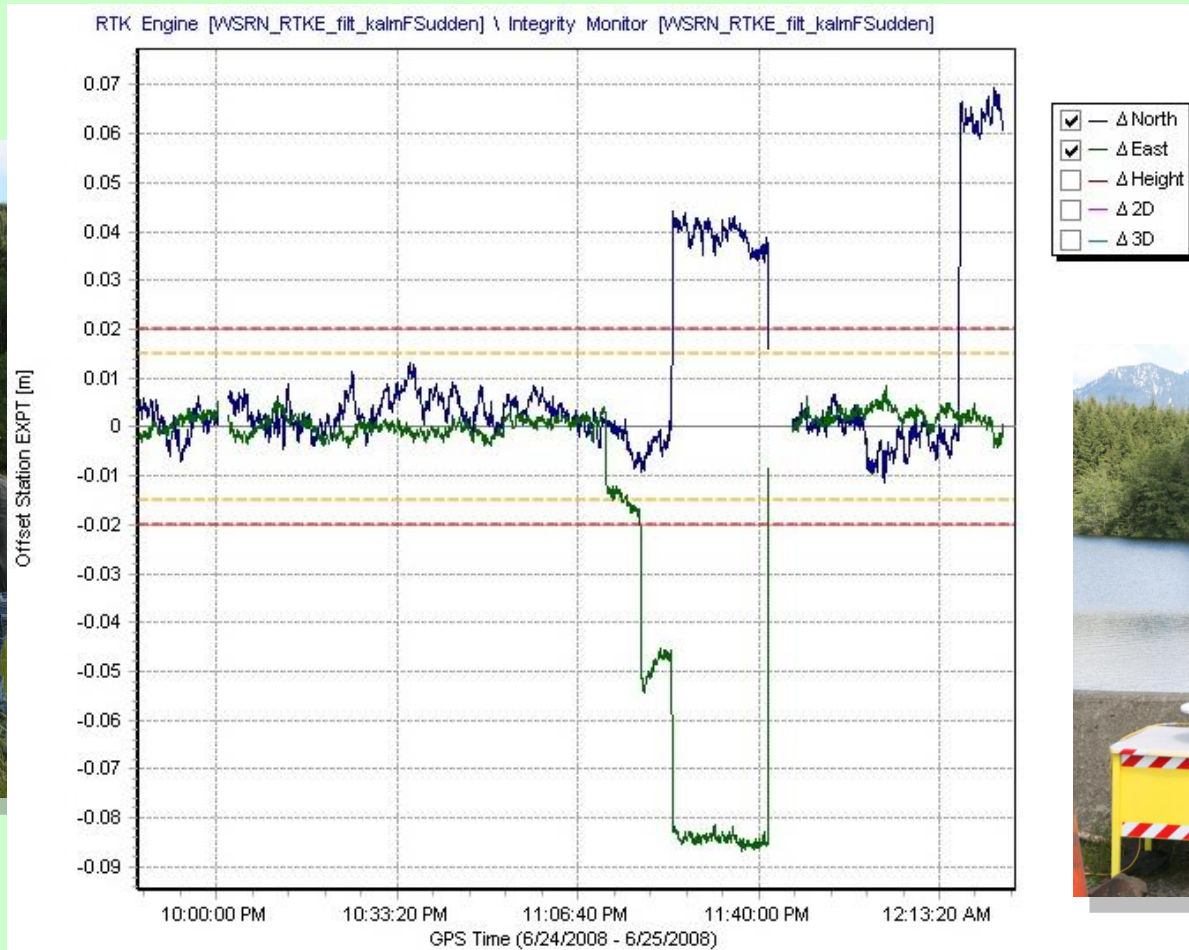*Individual Stations Monitored for Both Tectonic and Localized Motion*

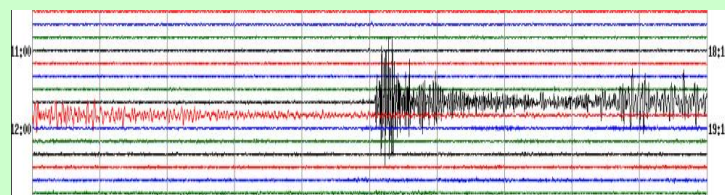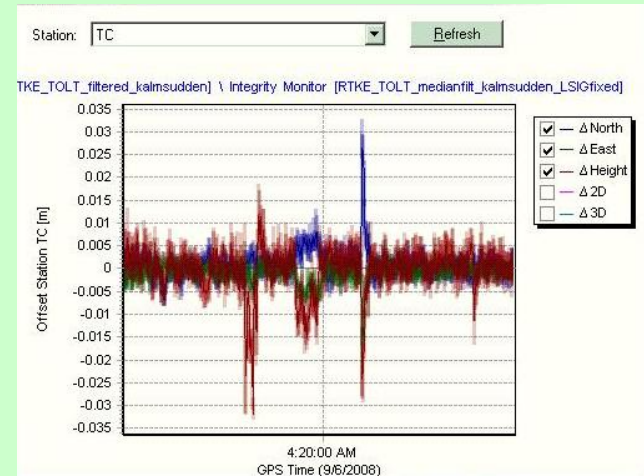# Washington State Reference Network
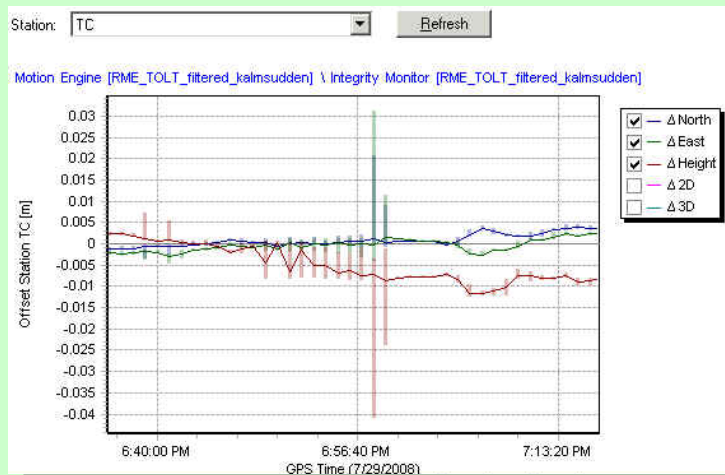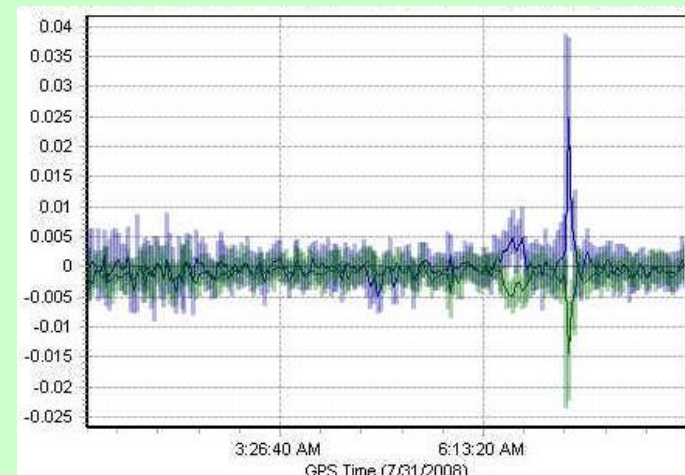## Tolt Dam Study

Washington State Reference Network
Tolt Dam Study

Washington State Reference Network
Tolt Dam Study

USGS Seismograph

*Movement and/or Perturbations of the
Ionosphere due to Seismic Events*

Thank You
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www.wsrn.org